# THESIS

on

# THE SYMPTOMS AND DIAGNOSIS OF PYLORIC OBSTRUCTION.

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Diseases of the stomach form a large proportion of the cases met with in general practice. Their treatment in these circumstances is often prolonged and unsatisfactory because a thorough examination of the stomach and its functions is considered inconvenient or unnecessary, and although many accurate clinical methods are available they are too rarely employed until the disease has resulted in gross lesions of the stomach, requiring some surgical interference and perhaps beyond the possibility of cure.

Many cases of pyloric obstruction of this kind have come before me, and their diagnosis has sometimes been a matter of difficulty.

I propose therefore to discuss the signs, symptoms and diagnosis, first, of pyloric obstruction generally, and secondly, of each form of pyloric obstruction.

Any obstruction occurring at the pylorus interferes with the normal propulsion of the stomach contents into the duodenum. When the obstruction is established gradually a compensatory hypertrophy of the gastric muscles occurs behind the seat of the obstruction particularly in the pyloric region, the muscular layer of which may grow to two or three times its normal thickness. The musculature of the fundus shows little or no hypertrophy. The mucosa also becomes thickened and thrown into folds. For a time this hypertrophy compensates more or less perfectly for the obstruction, and the capacity of the stomach remains normal or may be diminished. But as the obstruction continues or increases the compensatory hypertrophy reaches its limit. The stomach is no longer able to propel its contents within the normal time, i.e. a relative motor insufficiency of the stomach results. As soon as this occurs the stomach walls suffer. They begin to lose their contractile power from the cardiac to the pyloric end of the stomach progressively and dilatation follows in the same order. The mucosa shows a chronic gastritis. The absorptive and secretory powers become more and more impaired, as well as the motor power. Fermentation occurs in the stagnating stomach contents and

helps to increase the dilatation. Degeneration and atrophy of the mucous and muscular coats follow. In time there results a general dilatation of the stomach which may become extreme and permanent. The stomach dilates in the direction of least resistance, displacing other abdominal organs, and in rare cases the heart or lungs. The dilated stomach itself is displaced downwards and becomes more vertical, the pylorus being dragged downward and to the left, unless prevented by adhesions.

These are the typical changes in the stomach which follow pyloric obstruction. But there are cases in which obstruction is not followed by dilatation, e.g. firm perigastric adhesions, cirrhosis of the stomach, infiltration of the stomach walls with cancer or excessive and continued vomiting may cause a reduction instead of an increase in the size of the stomach.

SYMPTOMS AND PHYSICAL SIGNS OF PYLORIC OBSTRUCTION:

The first symptoms of pyloric obstruction are a feeling of fulness or discomfort in the region of the stomach, coming on shortly after meals and accompanied by a feeling of spasmodic, colic-like movements in the stomach - the peristaltic unrest of Kussmaul. But there is no serious stomach trouble so long as compensation is sufficient. Vomiting in time becomes a

constant symptom. At first it may come on after meals being preceded by a feeling of cramp or pain in the region of the stomach. As dilatation of the stomach increases the vomiting becomes less frequent and at intervals of two or three days, very large quantities of fermenting, sour-smelling material are regurgitated, some of which has lain in the stomach for several days. The patient gets temporary relief after the vomiting, but a part of the stagnant liquid remains behind in the stomach and contaminates the next ingesta. The course of the case will depend on the primary disease which is causing the obstruction, but in every case definite results follow, owing to the impaired metabolism, autointoxication by the stagnating stomach contents and the inability of the stomach to absorb water or to propel it into the intestine.

The patient becomes very emaciated, the skin and mucous membranes become dry, shrivelled and anaemic. The temperature is subnormal. The pulse slow and feeble. The patient may occasionally have dyspnoeic symptoms. The patient suffers from unquenchable thirst, often proportionate to the degree of gastrectasy. There is constipation with dry, hard stools, but occasional attacks of diarrhoea may result from irritation of the intestines by the putrefying stomach contents. The urine is scanty, of high specific gravity, and contains phosphates, especially the triple

phosphates and sometimes small quantities of albumin. The chlorides are generally reduced. Various nervous phenomena are observed such as depression, headaches, vertigo and various sensory disturbances, and in rare cases tetany. Tetany is most liable to come on after severe vomiting or diarrhoea. Passage of the stomach tube sometimes excites it. It appears in the form of tonic contractions of the muscles of the extremities, and may be associated with an intermittent form of spasm of the neck and trunk muscles or with general convulsions of short duration. The spasms vary in severity and duration. The first attack is usually followed in a short time by others, but sometimes several days or months intervene between the first and second attacks.

The first step in the objective examination is the mapping out of the stomach by the simple external methods of examination. After this the motor condition of the stomach is ascertained. The presence of any obstruction at the pylorus is determined by these examinations and the results obtained may be verified by the X-rays.

In order to determine the nature of the obstruction, minute examination of the stomach contents is necessary.

After a general inspection of the patient's condition we examine the stomach. Inspection in early

cases reveals nothing. When hypertrophy and dilatation are present, distension of the stomach region is seen. This is brought out more clearly if the patient lies on his back with the abdominal walls relaxed. The room may be darkened and a strong light cast across the abdomen from the patient's shoulder, while the observer bends down at the foot of the bed with his eyes slightly above the level of the patient's body. The shadows cast by the inequalities and movements of the surface of the abdomen are more clearly brought out. The patient must also be examined in the erect position. A moderate degree of dilatation of the stomach may be invisible when the patient is lying down, but becomes evident when the patient stands up. The distension of the abdomen produced by a dilated stomach is asymmetrical. It is often most marked in the left half of the umbilical region and in the left hypochondriac region, less marked in the epigastric region. In cases of great dilatation with gastroptosis the epigastrium is retracted The stomach appears most prominent just above the greater curvature, the course of which may be seen descending on the left side from under the costal arch to a variable distance. In extreme cases it may reach nearly to the pelvis. It then curves round and upward to join the pylorus. The lesser curvature is never visible when the stomach occupies its normal

position, but in cases of advanced dilatation with gastroptosis the outline of the lesser curvature is sometimes seen passing downward, vertically, near the left parasternal line and forming a curved outline with ~~this~~ its concavity upwards, about the level of the umbilicus. Peristaltic movements should be looked for. They may vary a good deal from day to day. In advanced stages of the disease, when the gastric muscles are greatly enfeebled, they will probably be absent altogether. Two kinds of movements may be visible, either occurring together or separately. First, waves passing slowly from left to right, more rarely antiperistaltic waves moving in the opposite direction. Secondly, another kind of movement is sometimes visible - a hemispherical boss, as large as a Tangerine orange may rise up spontaneously and disappear again, and apparently reappear in another part of the stomach region. These irregular contractions may be present along with the regular peristaltic waves, or may be observed after the latter have disappeared. During the passage of the peristaltic waves, the outline of the stomach becomes more distinct, and both upper and lower curvatures may stand out in relief; and if the abdominal walls are very thin and relaxed, even a swelling may be seen occasionally in the pyloric region, rising up like a boss as the peristaltic waves reach it, and slowly disappearing as the

waves cease. The peristaltic waves may be exaggerated by slight stimulation, such as exposure of the abdomen to cold air, administering an efferverscing powder, etc. A diagnosis of pyloric obstruction can sometimes be made from inspection alone, when these signs are present.

Palpation is often negative in the early stages, or in patients with fat, rigid or distended abdominal walls. Sometimes ascitic fluid must first be removed. The bowels should always be thoroughly evacuated before examination. When dilatation of the stomach is present we can sometimes determine pretty accurately the position and boundaries of the stomach, by the elastic resistent feeling of its walls compared with the doughy feeling of the intestines. The patient also often experiences pain or discomfort as soon as the pressure of the hand passes on to the stomach area. A quick and simple method of gaining a rough idea of the position and boundaries of the stomach is to give the patient to drink a pint or more of cold water on an empty stomach. Palpation with a warm hand in a thin patient often gives an approximate idea of the position of the lower boundary of the stomach when the patient is standing up. The stomach walls during the passage of peristaltic waves are felt hardening, but after a minute or so they

relax and become elastic and compressible. In advanced stages the abdominal and gastric walls feel thin and flaccid. The pyloric region should then be palpated, and if a tumour is observed all its characters must be noted before and after inflation of the stomach, and with the patient occupying different postures.

Palpation should be followed by succussion. If the motor power of the stomach be insufficient, a succussion splash will be obtained at a time when the normal stomach should be empty. If the stomach be dilated the splash will be heard over a larger area than normal. The patient should therefore be examined about seven hours after the last meal, or else in the morning before breakfast. If the true succussion splash can be obtained at such times, we know that motor insufficiency is present. If the patient cannot relax his abdomen sufficiently, it may not be possible to elicit the succussion splash. In such cases we can usually succeed, if we press firmly on the lower part of the stomach, while the patient makes short rapid contractions of the diaphragm and abdominal muscles. If the stomach is much dilated the splash will be elicited over a large area to the left of and below the umbilicus. At the same time we must determine the position of the upper border of the stomach. Succussion sounds always cease if the

stomach contains no liquid, and if they are still present after the stomach has been completely emptied of its contents they probably come from the colon. Although in cases of severe ectasy it is very difficult to be sure that the stomach has been completely emptied. Gurgling or squelching sounds may simulate the true succussion splash. They are common in thin, nervous, dyspeptic women, and may occur in a normal stomach or colon. They are heard particularly when the stomach is almost empty and can be produced by the voluntary contraction of the diaphragm and abdominal muscles while the patient is standing. The true succussion sounds cannot readily be produced in this way as a rule, and they are best heard when the stomach is fairly well filled and when the patient is supine. Bubbling sounds are sometimes heard over the stomach. They are pathological only when heard very loudly, or when they occur at a time when the stomach should be empty.

Percussion: It is best to begin percussion with the patient in the upright position, because in this position we can often judge the size, shape and position of the stomach much more accurately than when the patient is recumbent. Percuss downward in the left parasternal line until dulness appears, caused by the fluid contents in the stomach. If the stomach

contains ingesta at a time when it should be empty, the presence of a dull area indicates motor insufficiency. Note the extent of the dull area. Then percuss with the patient lying down. The dull area is now tympanitic. But in order to estimate more exactly the form, size and position of the stomach, further examination is necessary. After removing the stomach contents, a Higginson's syringe may be attached to the end of the stomach tube and the stomach inflated. In passing, we may note that the tube may be pushed down to an unusual distance when much dilatation of the stomach is present. Better than air inflation is the administration of a teaspoonful of bicarbonate of soda and rather less tartaric acid, each dissolved in an ounce of water. The acid to be given first. Evidence of a dilated stomach is at once visible in many cases, especially in thin patients. Percussion shows the lower boundary at a variable distance below the navel; the upper boundary may also be displaced downward. The right and left lateral boundaries, particularly the left, will also show an increased area of tympanicity. Michaelis(1) has observed that in some cases the area of tympanicity extends far to the right of the middle line, and that there may be very little displacement in a downward direction. He considers the lateral enlargement due

to dilatation of the antrum pylori, and thinks that when it is found to extend more than nine or ten cms. to the right of the middle line, it nearly always indicates deficient motility of the stomach.

The pylorus after inflation, moves to the right and slightly downward, more rarely upward. But if it is firmly fixed by adhesions, inflation will not alter its position. The actual size of the stomach is considerably greater than the measurements obtained by percussion. Still, for obtaining a good approximate idea of the form and position of the stomach, inflation is very satisfactory. Another aid to the percussion of the stomach is to introduce definite quantities of water. The patient must sit up or stand. The stomach contents are removed, and the position of stomach is determined by percussion. The patient then drinks about half a pint of water, and the dulness on percussion gives us the lower boundary of the stomach. The patient lies on his back and the dulness disappears showing that the dull area was gastric. Patient sitting up drinks another half pint of water, and we find on percussion that the lower boundary of the dull area is perhaps an inch lower than before. A third draught of water causes a further lowering of the dull area, which we measure again. The amount of depression of the lower boundary of the stomach thus produced is an indication of the degree of atony of the stomach walls. It is also a good method for

demonstrating the position of the greater curvature of the stomach, but for showing the form and position of the stomach, especially the position of the lesser curvature, it is not to be compared with inflation.

In percussing a dilated stomach, we have sometimes noticed comparative dulness, instead of the tympanitic note, and on repeating the percussion a few seconds later, the characteristic tympanitic resonance was elicited. A cracked pot sound was sometimes heard over the temporarily dull area. This phenomenon was produced by a contraction of the hypertrophied gastric muscles.

Transillumination of the stomach and gastroscopy are too complicated for ordinary use, though some good results have been obtained by the latter method. The X-rays have also been employed very successfully in the diagnosis of some stomach diseases. They are sometimes useful in confirming the results obtained by the foregoing methods.

Boas and Levy-Dorn[2] eleven years ago used the X-rays for diagnosis of pyloric stenosis. The patient swallowed a capsule of gelatin, filled with metallic bismuth and covered with celluoid. When no stenosis existed the capsule was passed in the fæces within from two to six days. In cases of stenosis it was seen in the stomach for several days.[3] More recently the methods have been much improved. The bowels are

evacuated, and after emptying the stomach air is introduced to increase the translucency of the abdomen. One to two ounces of bismuth oxychloride which is an inert and harmless salt, are administered mixed with a pint of bread and milk, or made up with flour in the form of a roll.

The position, size and shape of the stomach may be noted with the patient standing up and lying down. The respiratory movements of the stomach and the movements of the stomach during digestion are watched, and the results compared with the appearances observed in a normal stomach.

In a healthy stomach all the bismuth disappears from the stomach in about three hours, except a small residue which remains for some hours in the most dependent part. In cases of pyloric obstruction the bismuth meal is detained abnormally in the stomach. The constricting waves which commence in the distal end of the cardiac sac and the waves passing along the pyloric tube are exaggerated owing to the compensatory muscular hypertrophy. When muscular degeneration follows, the circular fibres round the distal end of the cardiac sac show feebler peristalsis and a larger and larger part of the cardiac sac becomes part of the overflow reservoir for the stomach contents during digestion. The contractions of the sphincter aditus vestibuli become feebler. More and

more of the stomach becomes involved until it assumes the condition of a large, flaccid bag, unable to empty itself. The sphincter notches become invisible, and the bismuth meal instead of being held back from the pyloric tube by sphincter contraction as in a healthy stomach, passes directly from the cardiac to the pyloric portion.

Irregularities in the outline or movements of the stomach can sometimes be recognised by the X-rays. Local thickening of the gastric walls by a tumour gives no definite shadow, but adherence of the bismuth to a tumour or ulcer may occasionally be visible. (4) Another way suggested of using bismuth is to pass a stomach tube filled with a bismuth salt the patient being recumbent and the stomach having first been emptied. On the screen the shadow is seen emerging below the ribs on the left of the middle line. It passes along the greater curvature until it is arrested at the pylorus. The tube then adapts itself to the greater curvature.

There are several methods of estimating the degree of motor efficiency of the stomach, but the method of Leube (5) is the oldest and still the most accurate. He recommends a test meal consisting of a plate of soup, a biscuit, a beef-steak and a glass of water. At the end of seven hours the stomach contents are siphoned off; if the stomach is empty and

nothing can be washed out by lavage we know that the motor efficiency of the stomach is unimpaired. But if a considerable amount of undigested food can be pumped out, the motor efficiency of the stomach is undoubtedly reduced. The extent of its reduction is therefore measured by the amount of residue. If there is much residue the stomach may be washed out in the evening and a simple supper given; next morning before breakfast withdraw the stomach contents. The presence of any remains of the supper would indicate a very marked diminution of motor efficiency. The actual motor power of the stomach however, is not necessarily diminished. On the contrary, it is greatly increased as a rule in cases of pyloric obstruction. The test simply shows the degree of stasis of the stomach contents. It gives us no indication as to the cause of the stasis. Another simple test may be mentioned, viz. the Iodipin[6] test. Iodipin, which is a combination of Iodine and a fat, is rapidly split up by the action of bile and pancreatic juice, with liberation of Iodine, but it is not acted upon by the gastric juice. On giving a capsule containing one grain of Iodipin along with the test breakfast, Iodine is found in the saliva under normal conditions in from fifteen to fifty minutes after. Paper permeated with starch and a 0·5 per cent solution of ammonium persulphide is used

as an indicator and the saliva is tested every few minutes. In cases of pyloric stenosis the salivary reaction may be delayed for several hours. Any abnormalities of the secretions into the duodenum or regurgitation of the duodenal contents into the stomach are possibilities which would have to be taken into account.

DIAGNOSIS BETWEEN PYLORIC OBSTRUCTION AND OTHER CONDITIONS:

Diagnosis between Obstructive and Atonic Dilatation of the Stomach.

The etiology is of importance in the diagnosis. Local causes, such as dietetic errors, or general causes, such as anaemia or neurasthenia, have led to atonic dilatation of the stomach, whereas in the hypertonic or obstructive form of dilatation, ulcer, cancer, etc., are the primary causes. The development of the symptoms is generally slower and more uniform in atony. Pain is never acute in simple atonic dilatation. Pain is usually present in the different forms of hypertonic dilatation. It is aggravated by the tension on the diseased pylorus and is relieved by vomiting. Spasmodic movements in the stomach after meals, caused by the contraction of the hypertrophied gastric muscles are characteristic

of pyloric obstruction, and although similar movements may occur in certain forms of atony, e.g. atony complicated by hypersecretion, they come on chiefly in the intervals of digestion. The vomiting in early pyloric obstruction is more frequent and severe than in atony and is preceded by the spasmodic, cramp-like movements in the stomach. But slight degrees of acute atony, following indiscretions in diet may cause these symptoms. Such attacks however, are transient, whereas in cases of pyloric obstruction they grow gradually worse. Stagnation of the stomach contents is slight in the early stages of obstruction, but severe in the later stages, owing to the great degree of dilatation of the stomach. In atonic dilatation a more uniform degree of stagnation is observed throughout, and the stomach reaches only a moderate degree of dilatation as a rule. Its flaccid, atrophic walls show a marked contrast to the hard, hypertrophied condition of the stomach walls in obstructive dilatation, so that in the atonic stomach we never observe the strong peristaltic waves, so characteristic of obstruction in its hypertrophic stage. This difference is also shown by the way in which water enters and leaves the stomach during lavage. In an atonic stomach water enters quickly, drawing bubbles of air in with it. It flows out again slowly. In a hypertonic stomach the reverse is seen. A

pyloric tumour is never present in atonic dilatation. Marked improvement often follows therapeutic treatment in the atonic condition, but not in the obstructive condition. The opposite results are usually observed after gastroenterostomy.

Diagnosis between a dilated stomach due to pyloric obstruction and a simple gastroptosis is easy. In the latter case evidences of mechanical action or of bodily defects causing the gastroptosis may be found. In cases where there is no retention of the stomach contents, the patient often has no symptoms at all, and if symptoms are present they are usually the result of a nervous predisposition and are readily distinguished from symptoms of pyloric obstruction. Sensations of dragging or sinking in the abdomen and flatulence are among the commoner symptoms and they are often relieved or stopped altogether by upward pressure on the abdominal wall, so as to raise the viscera. Dislocation of other abdominal viscera, such as the right kidney, colon, etc., may be found. Evidences of motor insufficiency are absent. Inflation of the stomach is of great importance in the diagnosis. The upper border of the stomach is found to be displaced downward, and the upper epigastric region contains no portion of the organ. X-ray examination also gives a very typical picture. Below the light area which lies under the left arch of the

diaphragm is seen a long stretched-out vertical portion, the cardiac sac, the lower end of which may extend far below the umbilicus before expanding into the pyloric tube. Pressure on the abdomen or voluntary contraction of the abdominal muscles may raise it even three or four inches. When the patient lies down the Bismuth meal does not spread out to make one large shadow, but the central vertical portion still remains narrow.

But dilatation of the stomach often leads to gastroptosis and on the other hand, gastroptosis may be an important factor in causing dilatation. The pyloric region, occupying a low position and its walls being more or less atonic, becomes easily distended, and a kink occurs at the superior duodenal flexure, causing undue retention of the stomach contents and ultimately dilatation of the stomach.

Which is the primary factor in such cases may be determined by examining the history, course of development and physical signs of the case.

Hour-glass stomach might be confused with pyloric obstruction. The same primary diseases may produce either condition, and there is a similarity in the symptoms. Hour-glass stomach however, is rare and

often not recognised during life. The following are the chief diagnostic points.

Inflation may cause distension of the two portions of the stomach which are found on palpation and percussion to be separated by a furrow. The cardiac portion is the larger, but if the constriction be very deep, the pyloric portion may not become inflated at all. After aspirating the stomach contents as completely as possible succussion sounds may still be elicited over the pyloric portion and not over the cardiac portion. During lavage more water may be removed from the stomach than was poured in but sometimes we find the reverse. The water can sometimes be heard trickling through the constricted part, when the patient turns from side to side. Occasionally after emptying the cardiac sac the stomach tube can be manipulated into the pyloric sac and gastric juice of a different character withdrawn. These signs are rarely definite enough for a positive diagnosis. Inflation of the stomach is the most satisfactory of them.

The constriction in an hour-glass stomach very often occurs at the sphincter aditus vestibuli, and the X-rays show a marked indentation on the greater curvature of the stomach which closely resembles the

constriction seen in a normal stomach between the cardiac and pyloric portions, especially when the Bismuth meal has not distended the stomach sufficiently. In the latter case however, the constriction is not permanent. In advanced dilatation following pyloric obstruction the sphincter constriction is absent, so that the bismuth meal passes directly from the cardiac to the pyloric portion of the stomach.

Other conditions, such as megalogastriøa or dilated colon are readily distinguished from gastrectasy due to pyloric obstruction.

Having determined the existence of an obstruction at the pylorus, its nature must be decided by examining the history and course of the primary disease and the condition of the stomach contents.

## PYLORIC CANCER.

Far more cases of pyloric obstruction are due to cancer than to any other individual cause.

The diagnosis of pyloric obstruction by cancer is made by studying the history and course of the disease and by an examination of the stomach and its contents.

In some cases the disease lies latent for a time. This type is most often seen in old people who show a

gradually increasing feebleness and decay, their slight dyspeptic complaints being overlooked. In another type of latent cases, the cancer is masked by some other disease, phthisis for example. or chronic Bright's disease which gives rise to some similar appearances such as pale yellowish complexion,anorexia vomiting, etc. Again in some cases the symptoms caused by secondary growths obscure the primary disease, e.g. secondary cancer of the liver or pancreas. It is impossible generally to judge from the patient's symptoms how long the tumour has been growing. The patient is usually elderly. In young patients the course of the disease is much more rapid. The early symptoms are insignificant, and the onset of the disease is generally gradual. The first complaint is of slight dyspeptic symptoms, often in patients who have never suffered from any gastric trouble before. There is a feeling of fulness or discomfort, or a dull aching pain in the epigastric region with belching and an occasional attack of vomiting. Loss of appetite may be the first symptom. In some cases there is a general distaste for all food; in others a special distaste for meat and rich food. Osler and McCrae[7] found a distaste for meat in comparatively few cases. Exercise, fresh air and tonics cause no improvement in the symptoms. In some patients the appetite remains good for a considerable time. Loss

of weight and strength are occasionally the first symptoms, and in a few exceptional cases the patient's attention is first attracted by a tumour in the abdomen.

As the disease progresses epigastric pain becomes a more prominent symptom. Its character varies very greatly. It is frequently described as a constant, gnawing pain. As the stenosis increases it is often worse after food, and is accompanied by feelings of distension and by spasmodic movements in the stomach. Ulceration of the tumour often causes increased pain after meals or continuous pain. Adhesion of the pyloric tumour to the under surface of the liver is apt to cause pain in the right side of the chest and right shoulder, and adhesions posteriorly cause pain in the back. So long as the motor power of the stomach remains efficient the patient's general condition may be good, but with stagnation of the stomach contents, secondary gastritis and ulceration of the tumour, there occur rapid failure of strength, emaciation and cachexia.

Vomiting is frequently an early symptom in pyloric cancer. (It may cease when ulceration has opened a passage for the stomach contents, and the patient may appear to improve for a time.)

Slight haemorrhages take place from the growth, and the altered blood has the appearance of dark coffee

grounds mixed with the stomach contents. Severe haemorrhage very rarely occurs from scirrhous cancer, the form that is most commonly associated with pyloric stenosis. The patient gets some relief for about twenty-four hours after an attack of vomiting. From time to time the patient suffers from severe continuous vomiting, caused usually by a sub-acute gastritis.

There is obstinate constipation throughout the course of the disease, but occasional attacks of diarrhoea may occur in the later stages. All the other secondary phenomena of obstructive dilatation of the stomach are present. These are the typical symptoms observed in pyloric cancer. It should be mentioned however that the stomach is not necessarily dilated in all cases of cancerous pyloric obstruction. Infiltration of the stomach walls and severe continued vomiting may lead to contraction of the stomach. The course of pyloric cancer varies greatly in rapidity in different cases. It may last for even three years. It usually terminates within eighteen months, but if stenosis is severe the duration is seldom more than nine months.

Objective examination:

Inspection in early cases is often negative, the patient presenting a perfectly healthy appearance. The patient may be young, well nourished and have a good colour. In the later stages the complexion is

sallow and ashy, the skin dry and flaccid and the muscles wasted. Enlarged glands may be seen above the clavicle, especially on the left side; their absence however has no significance. The presence of metastases, palpable about the umbilicus or a cord-like thickening of the linea alba is a valuable sign. The tongue is covered with a thick slimy coat, and sulpho cyanide of potassium in the saliva is greatly reduced. Signs of a dilated stomach and peristaltic waves may be visible and perhaps a swelling is seen in the pyloric region, moving up and down slightly with respiration. In well marked cases the condition can sometimes be recognised by inspection alone.

The size, shape, position and tenderness of the stomach are determined and perhaps a tumour is discovered. As a rule a tumour is not perceptible until the disease has existed from three to six months. Sometimes it is not palpable throughout the whole course of the disease. Some pyloric tumours are palpable in one position of the body and not in another. Others are inaccessible to palpation through being covered by an enlarged liver, or being obscured by ascitic fluid. A distended colon may push the tumour up under the ribs. Occasionally a greatly dilated stomach covers the tumour, which becomes palpable after the stomach has been reduced in size

by lavage. The position and accessibility of the tumour vary from day to day. This is largely due to the degree of distension of the stomach and intestines. The tumour may occupy almost any region of the abdomen, but its commonest site is about the junction of the umbilical and the right hypochondriac regions. When the stomach is empty it may lie in the epigastric or even the left hypochondriac region. When the stomach is much dilated the weight of the tumour and of the stomach contents combine to drag the diseased pylorus downward and to the left. Its degree of mobility when not fixed by adhesions is sometimes remarkable. The tumour is usually nodular, well defined and of a stony hardness. A massive, nodular tumour of the pylorus is invariably cancerous. Sometimes it feels more smooth and tubular in character. It is generally tender on pressure and gas can sometimes be felt and heard bubbling through it. On percussion it gives a dull tympanitic note. During the passage of the peristaltic waves it may contract and rise up under the hand. It is generally impossible to judge the actual size of the tumour. Muscular hypertrophy, enlarged glands and involvement of neighbouring parts may cause the tumour to appear to the touch larger than it really is. But as a rule the tumour is found after death to be larger than one would expect on palpation, because during life the

more prominent superficial portions are accessible, while the deeper parts escape detection. The small scirrhous tumour causes the greatest degree of gastrectasy. The aortic impulse is often felt in the tumour. It disappears however when the patient assumes the knee-elbow position. The degree of mobility of the tumour during respiration is greatest when the tumour is adherent to the liver or diaphragm; it is least when there is marked vertical displacement of the stomach and no adherence of the tumour to neighbouring organs. The recumbent posture, by keeping the fundus of the stomach against the diaphragm increases the degree of respiratory mobility. Expiratory fixation of the tumour is possible if it is not adherent to the liver. If the stomach be inflated we can trace its boundaries by palpation and percussion as far as the tumour in order to determine its connection with the stomach. The tumour will move downward and to the right as a rule, more rarely upward, and will return to its former position as the stomach becomes deflated; but if firmly fixed by adhesions to neighbouring organs, inflation will not change its position.

The pyloric tumour must be distinguished from certain other tumours which may be found in this region.

Tumour of the transverse colon.

Here the intestinal symptoms are more prominent. The bowel above the obstruction becomes distended with gas and fæces so that the tumour varies in size from day to day, a doughy consistence often being noticed owing to the presence of the fæces. Sometimes sloughing portions of the tumour are passed. Patient suffers from attacks of griping, colicky pain. There is abdominal distension with diarrhoea, passage of blood and slime occur from time to time. Increased intestinal peristalsis above the tumour and the characteristic abdominal patterns may be observed. The tumour may be mobile, like a pyloric tumour. Inflation of the stomach, and of the intestine if necessary aids the diagnosis.

A large faecal mass may be easily mistaken for a pyloric tumour. The gastric symptoms, emaciation etc. in cancer are generally diagnostic. Enemata will usually clear up the diagnosis.

The head of a normal pancreas is sometimes felt in very thin patients and may be mistaken for a pyloric tumour. It is immovable and deep-seated beside the vertebral column, in contrast to the superficial and very movable pylorus. The pancreas becomes quite impalpable after inflation of the stomach, provided that the stomach is in its normal position.

If however the stomach be displaced downward the pancreas is still felt in the same position as before, and by palpating and percussing along the greater curvature of the inflated stomach as far as the pylorus we can determine that it has no connection with the pylorus. Sometimes however a tumour of the pancreas, especially a cancer, is to be distinguished. The history of the disease may then be diagnostic. There is rapid emaciation, with early and persistent jaundice, jaundice being a later and very much rarer occurrence in cancer of the pylorus. Enlargement of the gall-bladder and ascites may be present. Fatty stools, glycosuria and sialorrhoea, if present, are useful diagnostic signs. On examining the abdomen, if any tumour can be felt at all, it is deep-seated and fixed and lies between the umbilicus and right costal cartilage or ensiform. The tumour may, by pressing on the duodenum cause dilatation of the stomach, but the above characteristic points and an examination of the stomach contents, distinguish it from a cancer of the pylorus. A case of chronic interstitial pancreatitis causing constriction of the duodenum and leading to dilatation of the stomach, is described by McKendrick.(8) Diagnosis of the condition was made by the excess of fat in the stools, Cammidge's reaction in the urine and the ultimate

appearance of glycosuria. Cancer of the gall-bladder closely resembles a pyloric cancer in some respects. There is usually however, a history of gall-stones and jaundice, unlike the progressive stomach symptoms of pyloric disease. Inflation of the stomach distinguishes the two conditions. The gall-bladder tumour is found to have no connection with the stomach. But this method of diagnosis is of little use if the pyloric tumour be adherent to the under surface of the liver. We must judge then by the history of the case. The gall-bladder tumour, though hard and nodular, may retain some of its pyriform shape and may feel elastic and fluctuating in places. Its lower edge is well defined, but it presents no definite edge above. It is very slightly movable from side to side, and descends with inspiration, but its expiratory fixation is impossible.

A cancerous tumour of the liver growing in a downward direction is expanded laterally, and causes the liver to appear enlarged and tuberous in its whole extent, unlike a pyloric tumour. The tumour moves downward with the rest of the liver, on inspiration, and expiratory fixation is impossible.

A movable right kidney is apt to be mistaken for a pyloric tumour. It often co-exists with gastrectasy or gastroptosis, although it is not the cause of either of

these conditions. In very many patients there are no symptoms whatever, but some patients complain of loss of flesh, epigastric pains, dyspepsia with occasional vomiting, scanty urine etc. The history of the case is often diagnostic. The patient is frequently neurotic and the symptoms are of long standing. There is a history of Dietl's crises. Palpation shows the characteristic form and consistence of the kidney, the hilum and vessels of which are sometimes palpable. When the patient, standing up, draws a long breath the floating kidney shows no tendency, on expiration, to slip back to its normal position. When the stomach is inflated it is found to have no connection with the kidney, and an examination of the stomach contents aids the diagnosis. A tumour of the kidney grows antero-posteriorly, pushing the intestines forward or to one side, but its relations to the colon are practically unaltered. It is associated with changes in the urine, such as the presence of blood, pus, tubercle bacilli, sarcoma cells, etc.

Tumours of the mesentery and peritoneum: Cancerous tumours are practically always secondary to cancer in the stomach, intestine, uterus, etc. The symptoms of subacute peritonitis are present. The tumour is more widely disseminated than a pyloric tumour. It is generally immovable. Inflation of

the stomach may show that the tumour is separate from the stomach. Aspiration is often necessary before a complete examination can be made. In cancerous cases a blood-stained, highly albuminous fluid, containing groups of cancer cells may be withdrawn.

Tubercular disease of the peritoneum and mesenteric glands is more easily to be distinguished, as a rule, by its history, its slower course and its more common occurrence in youth. Patient often has a rise of temperature in the evening. Palpation and percussion combined with inflation may be employed, and the stomach contents examined. if necessary. Evidence of tubercular disease in lungs or intestines is often present. A few other rarer conditions might give rise to a tumour in this region resembling a pyloric tumour, but the ones mentioned are of the most clinical importance. Tumours, arising from the pancreas, gall-bladder, kidney and other viscera may press upon the pylorus or duodenum or form adhesions with them, and so give rise to pyloric (or duodenal) obstruction. The more important points of diagnosis between pyloric obstruction from outside pressure & obstruction from causes within the stomach itself, are the ones just mentioned. No further reference will therefore be made to this variety of pyloric obstruction.

The motor efficiency of the stomach may be good in the early stages of pyloric cancer or it may be

greatly impaired. When once the functional balance is lost, motor insufficiency increases rapidly. The stomach contents show abundant coarse fragments of undigested meat, bread, etc. mixed with mucus. As the disease progresses blackish coffee-ground material is found in the vomit and sometimes the stomach-tube on withdrawal is streaked with a little fresh blood. Microscopically we find muscle fibres, starch granules, fat droplets, torulae sarcinae and various bacteria. Oppler-Boas bacilli are present in great numbers when there is much stagnation of the stomach contents. They are readily seen when stained.

Palier[9] found a combination of micro-organisms in the gastric juice in cases of cancer which he could not find in any other condition of the stomach, viz: the presence of the vibrio geniculatus ventriculi and of numerous staphylococci, with absence of mycelia. Up to the present however, the only important micro-organisms found in the stomach are the Oppler-Boas bacilli, and these are only significant if present in large numbers.

Unchanged epithelial cells are also found. They indicate great diminution in the secretion of gastric juice. The constant presence of pus and blood under the microscope, if their origin from an acute phlegmonous gastritis or purulent inflammation in other parts can be excluded, is a valuable sign of an

ulcerating carcinoma within the stomach[9a]. Small traces of blood in the stomach contents or fæces are best discovered by Weber's test. In examining the fæces for concealed haemorrhage, the patient should eat no red or half-cooked meat for at least two days before the examination. Several examinations are often necessary and the possibility of any other source of haemorrhage has to be eliminated.

The only pathognomic sign of cancer is the detection of the tumour particles. Very occasionally they may be discovered in the stomach washings or in the eye of the stomach-tube. The soft adenocarcinoma shows the greatest tendency to slough. Reineboth[10] states that tumour particles may be found occasionally within the small blood coagula washed out during lavage.

Before tumour particles have been detected however, a correct diagnosis has generally been made. Hemmeter[11] has therefore suggested a method for the earlier diagnosis of the disease. After emptying the stomach by lavage, half a pint of warm, normal saline solution is introduced through an ordinary stomach tube made with sharp edges, by means of which the gastricmucosa is scraped. A second half-pint is introduced, and the whole is then withdrawn. The deposit is centrifugalised and examined microscopically. The presence of cells undergoing a typical mitosis, the chromosomes being unequally divided between the poles, is suggestive of a new growth.

The chemical examination of the stomach contents is best carried out by washing out the stomach in the early morning and then giving Ewald's test breatfast. The stomach contents are withdrawn after one hour and filtered. It may be necessary to repeat the examination a few times at intervals of three or four days if the diagnosis is uncertain. A test meal, to be withdrawn at the end of three hours, is also sometimes employed.

The usual tests are employed to determine the amount of HCl secreted and the existence of organic acids. If free HCl is absent we can determine its degree of deficiency by adding $\frac{1}{10}$ normal HCL to the stomach contents until free HCl can be detected. The quantity of HCl necessary for this shows the degree of deficiency in the secretion of HCl. The exact determination of pepsin secretion is unnecessary. It runs parallel with the HCl secretion, but fluctuates less. Pepsin is always present in the stomach contents, except in cases of complete atrophy of the mucosa. To determine the existence of lactic acid, Ewald's breakfast is sufficiently accurate, and the separate trial meal, recommended by Boas, need not be given. Acetic and butyric acids may also be found.

Salomon[12] has proposed a new method for the early diagnosis of cancer. It depends on the fact that a serum containing albumin separates from cancerous tumours. The stomach of the patient, while

fasting, is washed out thoroughly with water in the evening, and in the morning 400 cc. of physiological salt solution is introduced. This is subsequently withdrawn and the albumin estimated by Esbach's reagent, the nitrogenous constituents by Kjeldahl's method. If cancer is present the solution gives a thicker and more flocculent precipitate of albumin than normal and the nitrogenous constituents show an excess The tumour must have existed for some time and ulceration must have commenced before a positive result is obtained by this method, but it has occasionally been useful in diagnosis, when the tumour was not palpable. It is of no use in distinguishing ulcer from cancer, because albumin is present in both cases.

To avoid the use of a test-breakfast and stomach tube other methods have been devised. Ewald's test breakfast however remains the most satisfactory. But either of the two following methods may give useful confirmatory results.

The method suggested by Schwarz[13] is to give the patient $\frac{1}{3}$ or $\frac{1}{2}$ oz. of bismuth subnitrate, enclosed in an envelope of connective tissue, obtained from the vermiform appendix of the sheep or ox. On exposure to the X-rays, a deep black spot, the size of a farthing, is visible on the screen, occupying the lowest part of the stomach. As soon as the envelope is digested, the powder is dispersed within the stomach

and the contour of the organ is seen. This occurs within seven hours in a healthy stomach. If digestion is affected, as in cases of deficient secretion, the black spot may remain visible for 9, 10 or even 20 hours. If hypersecretion be present, the black spot disappears in from two to five hours.

Sahli's[14] desmoid test is somewhat similar. It depends on the fact that cat-gut in the raw state is soluble in gastric juice, but insoluble in the intestinal secretions. A pill of methylene blue is enclosed in a thin rubber membrane, which is then carefully tied up with a soft, raw, unsterilised cat-gut ligature. The patient swallows the pill after the mid-day meal. If the gastric functions are normal, the pill is liberated and methylene blue appears in the urine in from 5½ to 7½ hours. When the reaction in the urine is retarded or negative, a deficiency of gastric juice is indicated. The test is simple, and gives the patient no distress. It shows the secretory power of the stomach at its best, viz: after the mid-day meal, and may therefore give a positive result, though the test-breakfast shows no free HCl. On the other hand, a diseased condition of the kidneys, intestines, circulatory system, etc., may lead to fallacious results. Schwarz's method has the advantage in this respect. But both the methods are of value as tests for free HCl, auxiliary to Ewald's test-breakfast.

Absence of free HCl is an early symptom in most

cases of cancer of the stomach, and is often observed before any marked symptoms of gastric disturbance show themselves. If a patient comes complaining of slight dyspepsia of short duration and if free HCl is constantly absent from the stomach contents after three or four examinations made at intervals of a few days, early cancer should be suspected, even though the patient appears perfectly healthy otherwise. The reduction in the HCl secretion is progressive and depends on the degree of atrophy of the gastric mucosa. At first free HCl disappears then the combined HCl diminishes, but very rarely does HCl secretion cease altogether. Surgical removal of a cancer may check the gastric process and cause a return of free HCl for a time, but in no other disease is the reduction of HCl secretion so rapid and progressive. In a few cases however in which cancer develops from an ulcer we find an excess of free HCl in the early stages of the disease and the free acid may persist in the stomach contents for a long time, even until death, according to Rosenheim[15]. Such cases are rare. Rosenheim considers that the cancer develops chiefly in the deeper parts of the ulcer, leaving the mucosa intact for a long time. Osler and McCrae made histological examinations of a number of cases in which free HCl had been present and found only slight degrees of interstitial gastritis and atrophy of the mucosa. In some cases ulcer had preceded the cancer, but in others

there had been no ulcer. Cases like the latter however are very exceptional.

The constant presence of abundant quantities of lactic acid in the stomach contents is significant in conjunction with other signs of cancer, in the same way as is the absence of free HCl. It may cause the total acidity of the stomach contents to be normal or slightly above normal. Osler[16] and McCrae found lactic acid present in 75.5 per cent of their series; of the remainder which showed absence of lactic acid, HCL was also absent. In such cases it is found that albumin digestion is normal or very little impaired. Where albumin digestion is greatly impaired lactic acid is always found. Hammerschlag[17] therefore thinks that the gastric ferments are partly concerned in the production of lactic acid. At any rate, two conditions characteristic of pyloric cancer are essential for its abundant production, viz: great reduction in the secretion of gastric juice and stagnation of the stomach contents, with deficient absorption in the stomach.

The Oppler-Boas bacilli are the most important lactic-acid forming organisms that are known. They vegetate on the carbohydrates of the food. Non-cancerous cases with atrophy of the gastric mucosa and stagnation of the stomach contents may occasionally show an abundance of lactic acid, but as a rule lactic acid in non-cancerous cases is rare, compared with its almost constant occurrence in cancer. Other organic acids, such as acetic or butyric, may occur.

## OTHER PYLORIC TUMOURS.

Other tumours of the stomach are of little clinical importance. Sarcoma of the stomach very closely resembles cancer. The average duration of all forms of sarcoma is longer than that of cancer, though the round-celled sarcoma sometimes runs a very rapid course. The occurrence of small subcutaneous secondary nodules is an important diagnostic sign. They may be very numerous and widely scattered. At first freely movable, they often become adherent to the skin later, and may ulcerate. The identification under the microscope of tumour particles in the vomit confirms the diagnosis. Other diagnostic points between sarcoma and cancer are:- The age of the patient, sarcoma occurring in younger subjects; splenic enlargement is not uncommon in sarcoma, rare in cancer; swelling of the tonsils and lymph follicles on the sides of tongue sometimes occurs in sarcoma; persistent albuminuria is common in sarcoma; and a slight, continuous fever is often present throughout the disease, whereas in cancer these signs are rare.

Polypoid of other benign tumours growing in the pyloric region may give rise to symptoms resembling those of ulcer, to symptoms of obstructive dilatation of the stomach, or to no symptoms at all. A diagnosis of the condition is impossible, unless the polypus be discovered in the stomach contents.

Malignant disease of the duodenum above the biliary papilla is very rare. A diagnosis from pyloric cancer is practically impossible.

Malignant disease in the neighbourhood of the papilla shows all the signs of pyloric cancer, and in addition, there is jaundice and absence of bile from the stools. The distended gall bladder and enlargement of the liver may be palpable. Haematemesis is rarer and melaena more common than in pyloric cancer.

When malignant disease occurs below the papilla, vomiting of bile and pancreatic juice occurs, there is rapid wasting, but no jaundice. The vomit is darkish green in colour, when allowed to stand in a glass a fine sediment of undigested food occurs unlike the coarse particles in pyloric cancer. The presence of a succussion splash to the right of the umbilicus after removal of the stomach contents, a fresh rush of fluid through the stomach tube when patient turns on his left side, and the presence in the morning of bile and pancreatic juice in the fasting stomach, after washing out the previous night;-these distinguish the case from one of pyloric cancer.

## PYLORIC OBSTRUCTION FOLLOWING ULCER.

In examining a case of pyloric obstruction following ulcer of the stomach, the previous history of the case is of great importance. Almost invariably

patient has had symptoms of gastric ulcer. As obstruction supervenes, the symptoms and physical signs of ulcer become changed or modified according to the pathological changes which have occurred in the stomach. If the ulcer has not completely healed or if secondary ulceration has taken place the symptoms of ulcer may still be conspicuous. The existence of hypersecretion or of chronic gastric catarrh will produce other symptoms. If marked stenosis and ectasy have occurred the symptoms will be chiefly those of pyloric obstruction, and further variations in the symptoms will be observed, according to the nature of the obstruction, whether caused chiefly by adhesions and inflammatory thickening or by cicatrical contraction. A complication of symptoms therefore often renders exact diagnosis difficult. In some cases there has been a typical history of gastric ulcer, with characteristic paroxysms of pain, vomiting and haematemesis. Then perhaps patient was free from symptoms for weeks or months and had a recurrence, from which he again recovered, though not so completely as before. With succeeding attacks the symptoms of dilatation of the stomach gradually develop. So the ulcer may have lasted for years, or the duration of the disease previous to the pyloric obstruction may be short, as, for example, the course of a cicatrising ulcer produced by some corrosive.

The first effect of the pyloric stenosis is to cause or to increase undue retention of the stomach

contents. This retention of food tends to produce an increased degree of hypersecretion, and the patient's symptoms become more and more those of chronic hypersecretion. The appetite remains good. It is often much increased. Carbohydrates frequently excite disgust. Patient becomes extremely thirsty. The increased appetite and thirst, in fact, might lead one to examine the urine for sugar. Patient complains of burning sensations in the stomach, acidity, flatulence and severe epigastric pain. The pain, unlike that of ulcer, comes on in the intervals of digestion and especially during the night. These symptoms are relieved temporarily by a little food or drink. An occasional attack of vomiting follows the symptoms. At first perhaps only in the night; in time, however, it becomes more frequent. The vomit consists of a variable quantity of a cloudy yellowish fluid, with an acid or bitter taste, and containing particles of undigested food, especially starchy food and small quantities of mucus. On standing in a glass, fine remains of amylaceous food sink to the bottom and the surface is capped with froth. The vomit contains pepsin and free HCL in normal amount or in excess and yeast cells, sarcinae, torulae, and other microorganisms are abundant. If vomiting occurs when the stomach contains no food, almost pure gastric juice may be thrown up, containing free HCl in normal amount or in slight excess. If, after thoroughly washing out the stomach

in the evening, we withdraw its contents next morning before breakfast and find a large quantity of pure gastric juice, amounting to 100 cc. or more, the existence of hypersecretion is proved. The bowels are very constipated, with occasional attacks of diarrhoea. The urine is small in quantity, with a deposit of phosphates and urates, and the chlorides show a great diminution. The patient, at this stage, may be considerably emaciated, and the case might be mistaken for one of pyloric cancer.

On examining the stomach we find motor insufficiency, and more or less dilatation, the result partly of the hypersecretion which interferes with carbohydrate digestion and causes undue activity in the pyloric sphincter, and partly of the organic stenosis itself. The effect produced by oil in many of these cases may be mentioned. The administration of large doses of olive oil often greatly diminishes the pyloroposm and lubricates the stenosed pylorus.

On examining the abdomen, strong peristaltic waves may be observed traversing the surface of the epigastrium from left to right. The stomach is tender on pressure, especially the pyloric region. There is muscular rigidity and we may find some circumscribed thickening about the pylorus. If an open ulcer exists and the stomach is in its normal position, there may be a tender pressure spot in the epigastrium, a little below the tip of the ensiform cartilage, and perhaps

another pressure spot in the back, situated somewhere between the seventh and twelfth dorsal vertebrae, slightly to the left of the middle line. We can apply further tests to find whether an open ulcer exists, such as irritation by salt water, or local anaesthesia by orthoform. Orthoform will not anaesthetise nerve endings which are protected by skin or mucous membrane. A history of recent haemorrhages would indicate an open ulcer.

From time to time patient suffers from attacks of subacute gastric catarrh, brought on perhaps by a chill or by some indiscretion in diet. There is constant retching and vomiting of small quantities of a viscid alkaline fluid mixed with bile and mucus. These attacks generally last a few days. Gradually the condition changes from one of hypersecretion to one of chronic gastric catarrh. The appetite fails and complete anorexia may follow. The tongue becomes thickly coated and the breath offensive. Patient suffers much from flatulence and discomfort and from vomiting in the early morning. The amount of free HCL in the stomach contents diminishes but it may still be in excess. This excess and the absence of much mucus distinguishes the case from one of simple chronic gastritis. As obstruction and dilatation of the stomach grow worse, vomiting becomes a constant symptom, the food taken through the day is vomited in the evening. The vomit is frothy and has a yeasty smell and is larger in quantity than the amount of ingesta. Pain is often absent

In advanced cases vomiting is more irregular, often at intervals of two or three days. Copious quantities of a dirty brown acid liquid are thrown up, a portion of which when poured into a glass separates into three layers. Remains of undigested food, both proteid and carbohydrate sink to the bottom. Above this is a turbid brown liquid, with a frothy scum on its surface. Microscopically, starch granules, fat droplets, torulae, sarcinae, bacteria, etc., are seen. The amount of free HCl varies. In severe cases it may be absent. Lactic acid is nearly always absent. Other organic acids, such as acetic and butyric are often present.

The patient's general condition is greatly reduced There may be extreme emaciation and anaemia,especially if there have been recurring haemorrhages from the ulcer. In advanced cases the complexion often has a waxy pallor. The skin and subcutaneous tissues are dry and shrivelled and oedema may be present in the lower extremities. A great diminution in the number of red corpuscles and in the amount of haemoglobin is found, although menstruation in these cases often remains quite regular, but scanty. On examining the abdomen pulsation of the aorta is marked. All the signs of a dilated stomach may be observed on inflation. Adhesions may have fixed the pylorus to some neighbouring part so that its position does not change; but if no adhesions have taken place the pylorus is

dragged downward by the dilated stomach, so that the lesser curvature can be detected, and any pyloric thickening becomes more easily palpable. Peristaltic waves are strongly marked in this condition, but they may ultimately disappear, owing to atrophy of the hypertrophied gastric muscles. Pressure over the pyloric region is very painful and the peristaltic contractions may be felt. There is rigidity of the overlying abdominal muscles. Sometimes a smooth uniform tumour or sometimes an indefinite induration is palpable at the pylorus. In some cases the thickened edges and base of an old ulcer give rise to a flat, plate-like tumour. Hypertrophy of the pyloric muscles, a thickened cicatrix, adhesions with neighbouring organs or enlarged glands may enter into the composition of the pyloric tumour. In rare cases a local exudate following perforation of the stomach gives rise to a tumour.

An examination of the stomach contents shows the characteristics already described.

Stenosis of the pylorus may result from combinations of these different conditions, but in some cases adhesions are the chief cause of the stenosis. They interfere with the motor function of the stomach. Dilatation follows, and the distended stomach drags on the fixed pylorus, producing a kink in the first part of the duodenum. There may be no actual contraction of the pyloric opening. Adhesions between the pylorus and the under surface of the liver are the most impor-

tant clinically and a diagnosis is often possible. The pain of ulcer becomes replaced by a pain which is referred, not to the epigastrium, but to a spot just below the right costal arch, from which it radiates into the right shoulder and right side of the chest. At first it may become continuous. It is increased by food and by exercise, and is often relieved when the patient lies down. Certain positions increase the pain by causing traction. The upright position often causes pain, and vomiting may also be a frequent symptom when the patient is about on his feet. When he lies down, the drag on the pylorus ceases, the stomach is able to propel its contents more easily and the pain and vomiting are relieved. Adhesions when formed cannot in themselves cause pain. It is traction which causes the pain. The pain is often out of proportion to the other stomach symptoms and is not dependent, as in ulcer, on the quality of the food, but on its quantity. Nor is it a paroxysmal pain. It is more of a steady, dragging pain. It is not amenable to the treatment which would stop the pain of ulcer. The patient becomes afraid of taking food, and gets emaciated. A condition of neurasthenia frequently results from long-standing adhesions, and one is very apt to regard the pain as simply neurotic. The latter however is more irregular and not always in the same spot like the pain of adhesions. The history and other physical signs further distin-

guish the case from one of neurosis. On inflation of the stomach the pain is increased. Evidences of a dilated stomach may be observed. The lesser curvature is in its normal position, and the greater curvature can be followed as far as the pylorus which is lying under the right costal arch. Palpation over the site of the adhesions reveals tenderness and abnormal resistence. In some cases there is a sensation of induration; and in others, a hard superficial mass may very occasionally be felt. It moves downwards on deep inspiration, but cannot be separated by expiratory fixation from the right lobe of the liver. The remaining physical signs and symptoms may be those of a pyloric stenosis following ulcer.

Adhesions occasionally form between an inflamed gall-bladder and a healthy pylorus and give rise to pyloric obstruction. A case of this kind must be distinguished from the preceding case in which the pylorus is the original starting-point of the adhesions. The patient has suffered, or is still suffering from symptoms of gall-bladder trouble. There has usually been a history of gall-stones.

The pain of biliary colic occurs in paroxysms like the pain of ulcer, but it comes on without warning, and when the patient is in good health. It is quite independent of meals, and is often followed by sickness. There is no history of haematemesis. Pressure over the gall-bladder about the ninth right costal cartilage gives pain. Pain radiates, not only

to the right shoulder, but also to the left infrascapular region when the inflamed gall-bladder has formed adhesions with the pylorus. Occasionally a hard mass, not tender on pressure, due to the presence of a large gall-stone, is palpable. The gall-bladder may be felt distended, and in some cases the tongue-shaped process of Riedel can be felt lying over it. An excess of free HCL in the stomach contents favours a diagnosis of ulcer.

These are some of the more important points which also serve to distinguish the case from one of pyloric cancer.

A gumma or a hydatid of the liver might occasionally give rise to adhesions with the pylorus.

In the diagnosis between a case of pyloric obstruction following ulcer and one produced by cancer, the character, course and duration of the symptoms are of great importance. In cancer, although for short periods the disease sometimes appears to remain stationary, when once the symptoms have appeared they progress steadily to a fatal termination within a limited time, in most cases not more than eighteen months; whereas the course of a case of ulcer is variable. The symptoms often disappear and reappear at intervals, so that the patient may have had symptoms of short duration or symptoms extending over many years before pyloric obstruction supervenes.

It is important therefore to note the difference between the chief symptoms of ulcer and cancer.

As a rule, the acute symptoms appear first in the case of ulcer and the symptoms of chronic gastric catarrh follow only when the ulcer has been present for some time. The early symptoms of cancer are usually slight and are those of a chronic gastric catarrh from the commencement. In cancer, emaciation and loss of strength are early symptoms. In ulcer they rarely occur until a late stage of the disease.

In comparing individual symptoms we find that in most cases of cancer, the appetite is soon lost and the tongue is covered with a thick, slimy coat. In ulcer the tongue remains moist and red, and the appetite good and very likely increased, up to a late stage of the disease.

The patient with ulcer refuses food on account of the pain which follows. The pain in uncomplicated ulcer comes on soon after food, and reaches its maximum severity in about two hours, after which it is relieved by vomiting, or subsides gradually. It is influenced by the quality of the ingesta. The pain in cancer is much more indefinite. It is more constant, often lancinating and independent of food. It it does occur after food it is less severe - not a paroxysmal pain, and it comes on later after food than ulcer pain. In the later stages of ulcer the hyperorexia, pain in the intervals of digestion and other neuromotor and sensory symptoms characteristic of chronic hypersecretion contrast with the symptoms of deficient secretion which occur in cancer.

Pain in cancer

~~It~~ is not much relieved by vomiting, but often increased. The vomiting in ulcer is early and severe and is closely associated with the pain. It is an irritative vomiting not generally accompanied by nausea, as in cancer. The vomiting due to obstruction and retention occurs at a late stage of the disease. The vomiting in cancer occurs irregularly. It is not a marked symptom, until some degree of pyloric obstruction has occurred. Appropriate diet and drugs soon relieve the pain and vomiting of ulcer, but the symptoms of cancer defy such treatment. In ulcer haematemesis is infrequent, but severe. It is generally accompanied by symptoms of fainting, etc., and is followed by melaena. If the blood is vomited quickly it is bright red and clotted. Haematemesis in cancer is much more frequent and constant, but occurs in small quantities. The blood appears as a black coffee ground material mixed with the stomach contents.

But sometimes in gastric ulcer, the typical symptoms of pain, vomiting and haematemesis are absent. The symptoms may be those of a chronic gastric catarrh from the commencement; in other cases the stomach symptoms are insignificant, the chief complaint being a progressive emaciation and debility. In such cases it may be necessary to keep the patient under observation for a time before a diagnosis can be made.

The age at which the disease began is sometimes of importance. Cachexia and loss of strength begin earlier and advance more rapidly and steadily in cancer, and in the later stages patient shows an ashy

pallor that is not often seen in late stages of ulcer. Enlarged supraclavicular glands and metastases in the liver and other organs are not found in ulcer. Potassium sulphocyanide in the saliva rapidly diminishes in cancer and ultimately disappears. In ulcer it is found up to a late stage of the disease. On examining the abdomen, the painful epigastric and dorsal pressure spots, indicative of an unhealed ulcer, are absent in cancer. Peristaltic waves are often more marked in cases of pyloric obstruction following ulcer and the pylorus is usually more sensitive to pressure. A pyloric tumour is far more frequent in cancer and it appears earlier in the course of the disease. Its steady growth is very significant. It reaches a larger size and is often hard, nodular and very mobile. In cases of ulcer, if a pyloric tumour becomes palpable at all, it remains small and feels smooth and uniform. It is softer than a cancerous tumour and often more sensitive to pressure and it is generally firmly fixed by adhesions. Gerhardt[18] says: "If an affliction of the stomach has persisted uninterruptedly for more than three years, a small thin tumour speaks greatly in favour of ulcer."

An examination of the stomach contents is of the greatest importance in the diagnosis. Owing to the rapid digestion of food in the early stages of ulcer, provided that the ingesta remain long enough in the stomach, the vomit is small in quantity, fine, pultaceous with an inoffensive smell; meat is well di-

digested and there is an excess of free HCL and absence of lactic acid.

The vomit in early cases of cancer may consist of a quantity of viscid mucus, or it may consist of large amounts of undigested food, particles of which have been several days in the stomach. The smell is very disagreeable. In either case, there is probably some lactic acid, but little or no free HCL present.

In the later stages of ulcer, with pyloric stenosis and chronic hypersecretion, the stomach contents consist of a greenish yellow fluid, with froth on the surface from yeast fermentation, and a sediment of carbohydrates. There is very little mucus. In cancer the vomit is dark brown, bile is generally absent, there is no yeast fermentation and large quantities of undigested proteid and carbohydrate food are found in the deposit, mixed with much mucus. Oppler-Boas bacilli remain absent or scanty in ulcer, while the absence of lactic acid and the presence of free HCL often persist to the end. The presence of epithelial cells undergoing irregular mitosis is suggestive of cancer and the finding of tumour particles renders the diagnosis complete.

Diagnosis of the development of cancer on the basis of ulcer is made by repeated examinations of the symptoms and physical signs. Chemical tests show nothing characteristic in the early stages. A positive result is of some value in confirming the clinical observations, a negative result is entirely without significance.

In most cases the symptoms of cancer replace those of ulcer. The appetite fails. Nausea increases. The patient begins to lose flesh and strength more rapidly. Depression increases and there may be a sense of impending death. There is a change in the character of the pain from a paroxysmal to a more or less constant form. Cachexia develops then secondary metastases. Characteristic changes also appear in the stomach contents.

If the ulcer has undergone complete cicatrisation before cancer develops from it, the symptoms and physical signs are more distinct and the condition is more easily recognised.

In a few cases the symptoms of chronic ulcer remain prominent throughout. The only way of diagnosing these cases is to note the appearance and rapidity of development of cachexia, loss of flesh, tumour metastases, decrease of gastric secretion and other characteristics of malignant disease.

When the ulcer is very old and accompanied by chronic gastritis, and the patient is greatly emaciated and cachetic, diagnosis of a commencing cancer is often impossible.

## OTHER VARIETIES OF PYLORIC OBSTRUCTION.

In addition to the pyloric obstruction resulting from cancer, ulcer, adhesions and pressure from adjacent parts, there are certain other forms of pyloric obstruction in adults which have not yet been classified. Certain of these cases are supposed to be due to a congenital abnormality of the pylorus, since the only constant pathological change which has been found is a uniform elastic contraction of the pyloric ring. This is probably the condition described by Boas[19] as stenotic hypertrophic gastritis, in which the chief characteristics are a slowly progressive stenosis of the pylorus, with retention of the stomach contents and in some cases a tumour in the pyloric region. The symptoms in these cases are very variable, and depend on the degree of the stenosis, the general constitution of the patient and the dieting or other treatment to which the patient may have been subjected. The condition is most often met with in women. The patient first complains of fulness or discomfort coming on after meals. This may be followed by vomiting which gives relief. There is no severe pain as a rule. The symptoms may cease when the patient's diet is attended to, but if ordinary diet is resumed the symptoms are apt to return. These simple dyspeptic attacks occur at considerable intervals at first, but the intervals get shorter as time goes on and the stomach trouble becomes intensified as the attacks are repeated. No cause for these dyspeptic attacks

is apparent. Vomiting of blood is unusual. It has occurred in one or two instances, and gave rise to a diagnosis of ulcer. It was probably brought on by the strain of vomiting however. Symptoms of dilatation of the stomach and chronic gastric catarrh may appear in time, and the patient loses flesh. The symptoms of this disease have usually lasted for several years.

On examining the patient the usual signs of pyloric obstruction and a dilated stomach are found. In some cases the contractions of the pylorus may be palpable, but there is no permanent pyloric thickening. In other cases, where a hypertrophic stenosis of the pylorus exists a permanent thickening is palpable which varies from time to time as the peristaltic waves of the stomach pass through it. Two or three pints or more of dark, frothy fluid may be withdrawn from the stomach. The total acidity of the stomach contents is high and there is a considerable amount of free HCL, but no blood is found.

The history, symptoms and physical signs are usually quite distinguishable from those of cancer and ulcer, but the condition has hitherto only been recognised by opening the stomach.

Fibrous stricture of the pylorus is another condition whose etiology and pathology are not yet understood. It closely resembles the previous condition, but there are certain differences. The pyloric ring shows a firm uniform contraction. The pyloric

sphincter has disappeared and has been replaced by tough, unyielding fibrous tissue, quite unlike the elastic ring found in the condition just mentioned. There is no evidence of inflammation, ulceration or adhesions. Moullin[20] has described a series of these cases. Six out of the seven patients were women, and the disease had been diagnosed as gastric ulcer. The chief symptom was epigastric pain, more or less griping in character, coming on some time after food, and continuing for hours with varying severity. When the stomach was emptied the patient got relief, but vomiting was not a prominent symptom. There was superficial tenderness in the upper epigastric region. Deep tenderness was absent or ill-defined. Slight haematenesis, the result of vomiting, occurred in two cases. There was a history of long-continued dyspepsia in every case, and the onset of the disease was very gradual and indefinite. Fibrous stricture perhaps represents a further stage or a modification of the previous form of stricture. Moullin suggests that it is the result of long-continued spasmodic contraction, caused by persistent dyspepsia. Chronic gastritis may in certain cases cause hypertrophy of the mucous, submucous and muscular coats in the pyloric region and lead to severe degrees of stenosis, but in Moullin's cases there was no evidence that any such hypertrophy had ever existed, and it is unlikely that long-continued spasm of the pyloric

sphincter would lead to such a fibrous stricture. The earlier symptoms in these cases were possibly due to an abnormal condition at the pylorus of congenital origin, resembling or identical with the stenotic hypertrophic gastritis of Boas, in which the stenosis is the primary condition and the gastritis secondary.

Another form of pyloric obstruction due to long-continued spasm of the pylorus has been described, in which the patient suffers from griping pains in the epigastrium, relieved by vomiting. The appetite remains good. There is constipation. The patient may become emaciated. Signs of a dilated stomach and exaggerated peristalsis may be present and enlargement and tenderness of the pylorus may be found, especially during peristalsis. The symptons are very fluctuating in their severity, and the condition of the stomach contents shows variations, HCL being sometimes absent and sometimes present in excess. Opium alone relieves the gastric symptoms. The condition is a motor neurosis. It usually occurs in neurotic subjects, and is often associated with floating kidney.

Pyloric obstruction may be the result of chronic gastritis alone. In some cases inflammatory thickening of the mucosa and submucosa in the region of the pylorus leads to the formation of polypoid excrescences which may obstruct the pyloric opening. In other cases hypertrophy of the mucous, submucous and muscular coats causes the stenosis. And in rare instances, overgrowth of connective tissue may follow a chronic

gastritis, producing a sclerotic condition of the pylorus or of the whole stomach.

The history and course of the disease, with the objective examination will usually decide the nature of the case.

In congenital hypertrophic stenosis (21) the child (more often a male) is born apparently healthy and at full time. The symptoms usually begin in from two to five weeks after birth, sometimes a little earlier. Vomiting is the first symptom. It often occurs in children who have been fed on breast milk only. The vomiting in its typical form occurs only once or twice in the 24 hours. The vomit consists of intermediate meals and is large in quantity. Later on in the disease it is mixed with mucus. It is very rarely found to contain bile. The ferment activity is increased. The vomiting is forcible, the stomach contents being shot out through the mouth and nose. After vomiting the child is ready to drink, but fears to do so. The vomiting may be relieved temporarily but soon returns. The stools may be variable at first. When vomiting has set in, they are hard and scanty. The amount of urine is small and the child wastes rapidly. The duration of the disease varies. Fatal cases end in from four to twenty weeks. Sometimes the condition appears to clear up unexpectedly, and in some cases a partial stenosis perhaps remains till adult life. On examining the child, the temperature is subnormal, pulse small and frequent, the

tongue clean until gastric catarrh has occurred. The child may be greatly wasted. The upper part of the abdomen is full and the lower part sunken. Strong peristaltic waves are visible crossing the abodmen from left to right. A dilated stomach is found in some cases. On pushing the finger tips upward and inward under the right costal margin a small nodule,the hypertrophied pylorus is sometimes palpable. The characteristic vomiting, pyloric tumour and peristalsis are the important diagnostic signs.

Chronic vomiting with wasting may occur in the condition known as marasmus. Premature or unsuitable feeding may produce it. It is often accompanied by diarrhoea. The three characteristic signs of congenital hypertrophic stenosis are absent and the ferment activity and the total acidity of the stomach contents are low.

Chronic vomiting with wasting in infants may also be due to acid dyspepsia. Here the child is usually three months old or more before the symptoms begin. The symptoms are less severe and may cease for days together. Diarrhoea may alternate with constipation. Wasting is slow. There is a low ferment activity and the total acidity of the stomach contents is high. True peristalsis and pyloric tumour are absent.

In simple congenital stenosis of the pylorus the symptoms appear from the day of birth and death soon follows. The condition is extremely rare.

Other forms of vomiting in children are easily distinguished, such as vomiting in cerebral disease, etc., or cyclical vomiting which occurs in older children.

## ILLUSTRATIVE CASES

### I.

A charwoman, aged 56, multipara.

Complaint: Pain in the stomach and vomiting.

Patient has always been a small eater and a hard worker. Her work is heavy and she has lived a good deal on bread and tea. She has always been healthy until about a year ago. For a few years before that she used to suffer from indigestion at times, but says it was not serious

Her present illness began twelve months ago with flatulence and discomfort after meals. This grew worse and became constant and she began to have occasional attacks of vomiting preceded by nausea and uneasiness in the stomach, but there was never at any time severe pain. Undigested food taken at the previous meal was vomited, mixed with mucus. Vomiting became more frequent and often occurred two or three times in the twenty-four hours. During the last few months it has diminished in frequency, and only occurs once every three or four days, but three pints or more of sour, fermenting, dark brown, semi-liquid material are vomited, especially during the night, after which the patient feels much relieved. She has never noticed any haematemesis or melaena. Patient is constipated. Her appetite was good at first, but latterly it has failed and she has lost about a stone in

weight since a year ago. She has never been confined to bed and isstill doing a little work.

Objective examination: Patient is a small woman very emaciated. The face looks pinched and pallid. Mucous membranes only slightly anaemic. Red blood corpuscles 3,900,000. Haemoglobin 80%. Tongue slightly coated with whitish fur. Patient has had no teeth for a few years. Only stumps remain. No enlarged glands visible. On inspecting the abdomen, the epigastrium is retracted and slightly concave. Below the level of the umbilicus, the abdomen appears swollen and prominent. When the patient stands up the retracted upper portion and bulging lower portion of the abdomen are much more marked and the Patient is distressed and uneasy about the stomach. Upward pressure of the hands on the lower part of the abdomen or lying down again relieves this distress. Aortic throbbing is visible, but no peristaltic waves. Palpation shows marked flaccidity of the abdomen and gastric walls. There is no tenderness. A succussion splash is ob- obtained a finger's breadth below the umbilicus and extends downward to an inch above the pubis and laterally as far as the junction of the umbilical with the right and left lumbar regions. In the mammary line, about the junction of the epigastric and umbilical regions, a smooth, rounded, solid tumour is palpable. It is tender on firm pressure, and it appears fairly movable in all directions. It can be pushed up under cover of the liver. It descends

slightly on inspiration. With one hand pressing forward below the lower ribs and the other upon the abdomen below the costal margin the tumour is more distinctly palpable, but it cannot be fixed at the end of inspiration. The lower end of the tumour is palpable, but not its upper end. Inflation of the stomach causes no change in the position of the tumour. The edge of the liver can just be detected below the costal arch in the mammary line. The spleen and left kidney are not palpable. There is no floating $10^{th}$ rib. Inflation of the stomach with $CO_2$ produces faint peristaltic waves which are seen crossing from left to right. It also brings out the stomach contour into bold relief. The loop-shaped lesser curvature is seen just below the navel. The greater curvature emerges from under the costal arch in the left nipple line, reaching downward to a point about an inch above the pubis, and extends to the right as far as the nipple line.

After washing out the stomach in the evening Patient was given a slice of bread and butter and half a pint of milk. A succussion splash could be elicited next morning over the stomach area before breakfast, and about $\frac{3}{4}$ pint of turbid, brownish liquid with an acid smell was withdrawn, containing pieces of undigested bread mixed with mucus. On standing a sediment of undigested food sinks to the bottom, above which is a brownish liquid with an abundant layer of froth on its surface. On washing out the

stomach, the water ran in very rapidly through the tube, and returned slowly, and the lower boundary of the stomach stretched nearly an inch after the introduction of two pints of water. An examination of the stomach contents after Ewald's test breakfast showed total acidity .173%, free HCL,.05%, lactic acid,test positive. No other organic acids. No blood and no bile. Microscopically, large quantities of starch granules are found, with sarcinae, torulae and yeast cells, and one or two Oppler-Boas bacilli were found here and there.

The urine was small in quantity, acid, S.Gr.1027. No phosphates. No albumin.

The case was diagnosed as one of atonic dilatation of the stomach, with gastroptosis and movable right kidney.

The dilatation of the stomach in this case was the result of chronic gastritis and of visceroptosis. It is difficult to say which was the primary cause. Probably there was a combination of both factors. It is evident that the case is not one of obstructive dilatation. There is no evidence of any hypertrophic condition of the gastric muscles. The tumour in the pyloric region resembles a pyloric tumour, but inflation shows that it is not connected with the stomach. Its consistence never varied and no gas passed through it. Such a definite solid tumour might have been a pyloric cancer, but the history of the case and the presence of free HCL are against this. There is no

history of ulcer. It has not the fluctuating feeling of a gall-bladder and its mobility is unlike that of a gall-bladder. There is no history of any attacks of biliary colic. The tumour must therefore be the lower end of the kidney, which has been displaced along with other viscera.

The patient has been seen recently and has greatly improved in her health by wearing an abdominal belt and by regular lavage of the stomach and suitable diet.

II.

A joiner, aged 52.

Complaint: Swelling in the body and legs, and sickness.

Family history: Mother died of an internal tumour. Patient used to drink a good deal of beer and spirits until four years ago, when he had Bright's disease, which was attributed to getting wet and cold. Since then he has been temperate but has suffered at times from sickness, headaches and swelling in the ankles. The present illness began about three months ago with loss of appetite, flatulence and discomfort after meals and headache. He had occasional attacks of vomiting, after meals. A few weeks after the abdomen began to swell and breathing became difficult. The case was diagnosed as one of chronic Bright's disease and sent to hospital

On admission Patient appeared pallid and of a sallow complexion. There was some puffiness about the eyes. The face, body and limbs were somewhat emaciated. Patient was very dull and languid. The abdomen and lower extremities were oedematous. Red blood corpuscles 4,400,000, white blood corpuscles 11,000, Hb 75%. The heart was hypertrophied and dilated. The arteries somewhat thickened and the pulse tension high. Urine small in quantity and contained much albumin with fatty and granular casts. Bowels constipated. The abdomen showed general distension with fluid. The stomach showed no signs of dilatation. No tumour was palpable, but Patient complained of some pain and tenderness in the epigastrium and vomited small quantities of greyish material. mixed with a good deal of mucus but no blood. The vomit was not examined. Patient died shortly after admission from uraemic coma.

Post mortem: A small hard cancerous ulcer was found on the posterior wall of the ~~abdomen,~~ stomach an inch above the pylorus. Pylorus somewhat thickened and rigid. One or two enlarged glands near the head of the pancreas, but no other metastases.

III.

A labourer, aged 53.

Complaint: Pain in the stomach and vomiting.

Family history good. Patient has always been temperate and enjoyed perfect health until a year ago, when he began to be troubled with flatulence and dis-

comfort in the epigastrium after meals. These symptoms gradually got worse in spite of treatment and he began to have occasional attacks of vomiting, which generally came on if he took anything indigestible. His appetite was good at first, but began to fail and he felt tired and unfit for work. He had now a constant aching pain in the stomach which was worse after meals and sometimes seemed to shoot all over his body. The vomiting became more frequent and occurred about every two days. More than a pint of offensive, sour-smelling liquid containing lumps of undigested food would be vomited. The vomiting mostly occurred in the evening and Patient slept better after it. During the last few months he has been confined to bed and has lost flesh rapidly. His appetite has completely failed. Vomiting only occurs about twice a week, but very large quantities are thrown up without any effort. Patient himself has never noticed any blood in the vomit. The bowels have been constipated from the commencement of the illness.

Objective examination: Patient's complexion has a pale yellow tint, with dark rings round the eyes, and slight colour over the malar prominences. Conjunctivae yellowish. The features are sunken. There is general emaciation. The skin is dry and hangs in folds. Mucous membranes anaemic. Temperature remained about normal throughout. Pulse feeble. Red blood corpuscles 3,500,000, white blood corpuscles 10,000. HC 45%. No enlarged glands are visible.

The tongue is covered with a yellowish, creamy coat. Teeth poor. The abdomen appears distended chiefly about the lower umbilical region. Slight peristaltic waves are seen traversing the stomach area from left to right. On palpation, no enlarged glands can be found. The whole abdomen is very flaccid, but the movements of the stomach can be felt. The epigastrium is tender on pressure. In the right parasternal line, about 2 inches below the costal arch is felt a nodular rounded mass the size of a large walnut. It is tender on pressure and moves slightly with respiration. It can be moved freely one or two inches in every direction. When the patient sits up it is felt close to the navel. Gurgling can be detected in it occasionally and a slight degree of movement when peristalsis is active. It shows some pulsation. When the stomach contents were removed the tumour was felt above the umbilicus just to the right of the middle line. On inflation of the stomach with $CO_2$ the tumour moved nearly 2 inches to the right. The greater curvature emerges from below the costal arch in the left parasternal line and extends downwards to three fingers' breadths below the navel. The lesser curvature is not very distinct. It is situated about 2 inches below the tip of the ensiform. Liver dulness normal. No nodules felt. The vomit consisted of 3 pints or more of very offensive semi-solid material, generally of a dark brown or drab colour, and containing abun-

dant remains of undigested food and mucus. Coffee-ground material was found sometimes, which when mixed with a few grains of potassium chlorate and a drop of HCL and evaporated in a porcelain dish gave a deep blue colour with potassium ferrocyanide solution. Microscopically, fragments of muscle fibres, starch granules, vegetable fibres, sarcinae, torulae and numerous Oppler-Boas bacilli were seen, but no tumour cells. Free HCL was absent. Lactic acid present. The test breakfast showed undigested pieces of bread. The filtrate was acid in reaction.

Total acidity .08, Free HCL absent. Well marked lactic acid reaction.

Urine: 20 oz in 24 hours. Deep colour. Deposit of phosphates and urates. S.Gr.1025. No albumin.

Patient was treated by lavage and it relieved the gastric symptoms for a time. It had then to be discontinued. Morphia and atropine were employed. Patient's strength failed rapidly and he died after being in a semi-comatose condition for one or two days.

Post mortem: The pylorus was indurated and thickened and the lumen rigid and contracted. Immediately above it was an ulcer an inch in diameter with very hard raised edges and a sloughing floor. A number of cancerous nodules were found along the lesser curvature and in the neighbourhood of the pylorus. No secondary growths were found in the liver. The stomach was much dilated. Its walls were thin and the mucosa smooth and atrophic.

IV.

A gentleman, aged 54.

Complaint: Pain in the stomach, indigestion and loss of flesh. Patient has lived an easy life, and has always been temperate in food and drink. He was never robust, but his previous health has always been good. There is no history of gall-stones.

The stomach trouble began about a dozen years ago with flatulence and attacks of pain in the stomach, which were worst about two hours after food, then passed off gradually. These dyspeptic symptoms were relieved by dieting and medicine. They generally lasted for a week or two and Patient remained well for a few months between the attacks. During the last year or two the attacks have been more prolonged. The pain has become more constant. The appetite is poor and Patient has lost flesh.

The present illness began six months ago with loss of appetite, heartburn and flatulence, and pain after food. Pain occurred in the epigastrium and shot along the right side of the chest and up towards the right shoulder. It is aggravated by exercise and by lying on the left side and is easiest when Patient lies on his right side with the body bent. Patient has been vomiting two or three times a day, a pint or more of yellowish fluid, mixed with undigested food and mucøus. Patient has never noticed any blood. The bowels have always been rather constipated.

On objective examination the patient is slightly emaciated and sallow. Conjunctivae jaundiced. Red blood corpuscles 4,500,000. Hb.78%. Arteries slightly thickened. Circulatory and respiratory systems otherwise healthy. Tongue covered with white fur. The abdomen shows nothing abnormal on inspection. The abdominal walls are fairly well nourished and rigid on palpation. Rigidity is marked over the right rectus near the costal margin. There is tenderness over the epigastrium and in the right hypochondrium just below the costal margin near the parasternal line. A small nodule as large as a chestnut is palpable here. It is very tender to pressure. It descends with inspiration, but is quite immovable. The liver dulness is normal. Neither the edge of the liver nor the gall-bladder can be felt. On inflating the stomach with $CO_2$ peristaltic waves are seen crossing from left to right and gas is heard bubbling through the pylorus. The stomach resonance extends from the sixth costal cartilage in the parasternal line to the umbilicus. The greater curvature can be traced upward to the nodule at the costal margin. The lesser curvature is in its normal position.

After a test breakfast a yellowish, slimy fluid was withdrawn, containing the remains of undigested bread. No blood was found. Total acidity .18%, Free HCL .07%. Lactic and other acids absent.

Gastroenterostomy was performed. Patient died an hour later.

Post mortem: On the under surface of the liver, close to its anterior edge and just internal to the gall-bladder was found a gumma. The pylorus was fixed to it, and embedded in a mass of adhesions. The pyloric lumen was narrowed, but quite patent. The stomach was moderately dilated. Its muscular coats were hypertrophied. Gastritis was present. There was no trace of any ulcer, and the gall-bladder was healthy.

V.

A woman, aged 49. A cook, unmarried.

Complaint: Pain in the stomach and vomiting. Patient's occupation has practically confined her to the house. She has always had an abundance of food, and used to be fond of tea. For seventeen years she has suffered more or less from her stomach, the chief symptoms being pain in the stomach, flatulence and acid eructations, with occasional attacks of vomiting. When her stomach first began to trouble her she had no vomiting, but just flatulence and discomfort after meals which passed off in a short time. Her appetite was good, but her meals were small and frequent. The symptoms grew worse in time and she had pain in the stomach after most meals, coming on about half an hour after food.

Occasionally she vomited a meal and the pain felt easier. The vomit tasted very sour.

About 11 years ago she suddenly brought up a large quantity of bright red blood. She was kept in the hospital for four months, after which she remained at her work for three years. The pain and vomiting however were gradually returning, in spite of careful feeding. She suffered very much in the night from burning pain in the stomach and flatulence, and often got relief by drinking milk. Without any warning she had another attack of haematemesis and vomited nearly a pint of bright red blood.. It was followed by tarry motions. After medical treatment in hospital she felt much better and had very little trouble with her stomach for some months. Pain in the stomach however returned. It was worst during the night and was followed by vomiting of copious quantities of watery, greenish liquid. Her appetite has failed and during the last nine months she has lost more than a stone in weight. Her bowels have always been constipated but much more so of late years.

Objective examination: Patient is emaciated and anaemic. Red blood corpuscles, 3,900.000. Hb 50%. Tongue red at the edge, covered in the middle with a dry fur. Artificial teeth. The abdomen shows some fulness about the umbilicus. The epigastrium is slightly scaphoid. Aortic pulsation is marked. Palpation is at first difficult owing to the rigidity of the abdominal walls, but when relaxed the walls feel thin and flaccid. There are no tender pressure spots in the epigastrium, but an area of great tenderness was

found just below the right costal arch, about 2 inches from the middle line. When the abdominal walls were relaxed an individual area of resistance was noted here. Slightly dull on percussion. When the stomach was inflated with $CO_2$, marked peristaltic waves appeared, crossing from left to right. Stomach tympanicity is present at the fifth left costal cartilage. The greater curvature emerges from the costal arch in the left parasternal line, extends downward to an inch below the umbilicus, and ends in the resistant area below the right costal arch. The lesser curvature is normal in position. A succussion splash was elicited over the stomach area before breakfast. No test breakfast was given, as the passage of a stomach tube distressed the patient. The vomit was examined. It was watery, greenish, with a yeasty smell, and on standing deposited food particles and developed froth on its surface. Some mucus was present. Microscopically, starch granules were very abundant; other food remains were found. Yeast cells, torulae and sarcinae numerous. No blood was found in the vomit or faeces. Free HCL varied from .08 to .11%. No lactic acid. Butyric acid present.

Posterior gastrojejunostomy was performed. At the operation the omentum was found adherent to the anterior abdominal wall, and some difficulty was found in turning up the colon to reach the jejunum. The stomach appeared flabby and dilated. No ulcer was found in its walls, but round the pylorus and duo-

denum there were numerous adhesions, and from the appearance there seemed little doubt that they enveloped an old gastric ulcer, situated close to the pylorus. The patient made a good recovery, and six weeks after had gained 4 lbs. weight. Three months later she had gained nearly a stone and had practically no stomach symptoms.

## REFERENCES.


1. Michaelis. American Journal of Medical Sciences August, 1898.

2. Roentgen Rays in Medicine and Surgery (Williams) p. 373.

3. Hertz. Guy's Hospital Reports. Vol. 61.

   British Medical Journal. Jan. 18th, 1908.

4. Reid and Dalton. Lancet, April 1st, 1906.

5. Leube. Medical Diagnosis.

6. Riegel. Dis. of Stomach. p. 139.

7. Osler and McCrae. Cancer of the Stomach.

8. McKendrick. Lancet, January 16th 1909.

9. Palier. Medical Record. November 19th, 1905.

9a. Ackerman and Gompertz. Medical Record. April 8th, 1905.

10. Riegel. Dis. of Stomach. p. 686.

11. Fenwick. Cancer and other Tumours of the Stomach. p. 160.

12. Salomon. Deut. Med. Woch. No. 31. 1903.

13. Lancet, February 17th, 1906.

14. Boggs. Johns Hopkins Hospital Bulletin. September, 1906.

15. Riegel. Dis. of Stomach. p. 679.

16. Osler and McCrae. Cancer of the Stomach.

17. Riegel. Dis. of Stomach. p. 682.

18. " " " 611.

19 " " " 392.

Maylard. British Medical Journal, February 20th, 1904.

20. Moullin. Lancet, January 19th, 1907.

21. G. F. Still. Lancet, March 11th, 1905.

Pfaundler and Schlossmann's Dis. of Children.
Vol. III, p. 199.